Space Weather Technical Forecast

Issued on Saturday, 23 December 2023 at 01:20 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of isolated M-class flares throughout. Chance of Active fluence on 23 December.

Analysis of Space Weather Activity over past 24 hours
Solar Activity: Solar activity has been Low with only C-class flaring observed in the last 24 hours. AR3519 has been the most active region of the ten on the visible disc, but is now close to the western limb and is difficult to analyse. AR3529 is the largest region but has matured and become relatively inactive. A line of active regions in the northern hemisphere are also evolving slowly, but with limited activity. The remaining regions are all either weak or benign. No potential Earth-directed CMEs have been observed on available imagery.

Solar Wind / Geomagnetic Activity: Solar winds are at ambient levels below 300 km/s with density below average. Total magnetic field strength has been weak, with the north-south component, Bz also varying weakly. Phi angle was firmly positive (away from the Sun). Total geomagnetic activity has been Quiet.

Energetic Particles / Solar Radiation: GOES16 high energy (greater than 10MeV) proton flux was at background levels. GOES16 high energy (greater than 2MeV) electron flux has been at moderate to high levels, with a peak of 1790 pfu at 22/1525 UTC. The 24-hour fluence started well below the Active threshold (1e8 integrated pfu) but has been steadily rising. Fluence at 22/0000UTC was 8.72e7 integrated pfu.

Four-Day Space Weather Forecast Summary
Solar Activity: Low activity is forecast, with a chance of Moderate activity. A slight reduction is forecast from 24 December as AR3519, the most active region, rotates off the visible disc.

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs are forecast. Solar wind speeds are expected to remain at mainly background levels through the next four days in the absence of coronal hole high speed streams or significant CME arrivals. Geomagnetic activity is expected to remain largely Quiet to Unsettled.

Energetic Particles / Solar Radiation: GOES16 high energy proton flux is at background levels and expected to remain at similar levels. There is just a slight chance of solar radiation storms, should there be any larger flares on the western side of the disc. High energy electron flux is expected to remain at moderate or high levels, declining from 24 December. Electron fluence may reach the Active threshold on 23 December, but then follow a declining trend as electron flux values decline.

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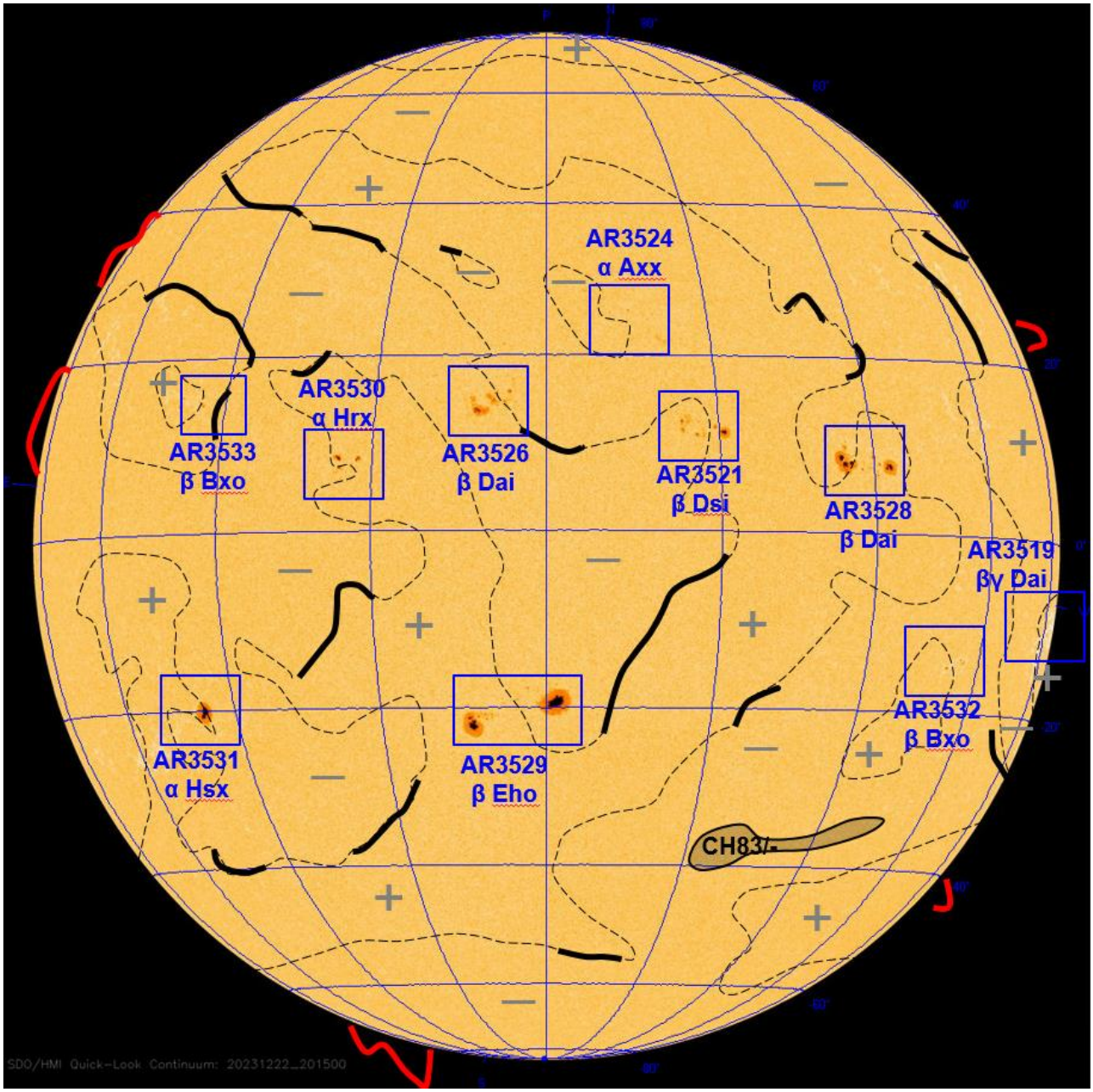
Figure 1. Solar Analysis Valid 22/2000 UTC.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:
No Earth-directed CMEs are forecast through the next four days.
A high speed stream from coronal hole 83 was tentatively forecast to connect with Earth on 22 December but is now considered unlikely to connect. No further coronal holes are expected to connect with the earth through the remainder of the forecast period.

Geomagnetic activity is forecast to be mainly Quiet to Unsettled throughout the period.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

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Radio Blackouts - X-Ray Flares:

There are ten sunspot regions on the visible disc, with AR3519 the most active region. This is approaching the western limb and should rotate onto the far side of the Sun through 23 December. AR3529 is the other large region, in the southeast quadrant, but is mature and stable, with no significant activity observed through the last 24 hours. A string of regions in the northern hemisphere have been observed to be evolving slowly, but are also appearing benign.

Ongoing risk of M-class flares, mainly from AR3519, but this is due to rotate off the disc during 23 December. This will lead to a slight reducing in risk of M-class flaring from the 24 December.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	40	40	30	30
Very Active	R3 to R5 X Class	No	5	5	5	5

Solar Radiation Storms - (High Energy Protons):

The high energy (greater than 10MeV) proton flux observed by GOES16 is at normal background levels and is most likely to remain at similar levels. However, there is a slight chance of minor solar radiation storms throughout, initially from AR3519 before it rotates across the southwest limb, but also from the regions currently in the eastern hemisphere as they rotate into a more geoeffective position.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	10	10	10	10
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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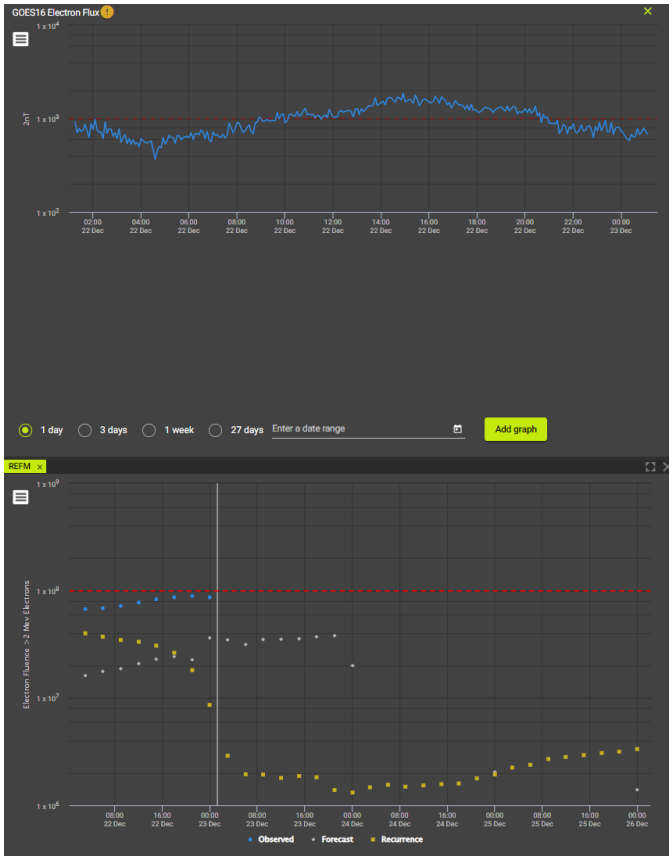
High Energy Electrons Event (≥ 2MeV):
High energy electron flux (greater than 2MeV) has been oscillating between moderate and high levels through the last two days following the input from the high speed stream from coronal hole. No further inputs are expected through the next four days, with a steady decay in electron flux values expected.

Electron fluence has been steadily approaching the Active threshold, with only a chance of exceeding the threshold due to an easing solar wind. A decline is then expected from 24 December to the end of the forecast period.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	50	40	20	10
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 2: GOES 16 electron flux and electron fluence.



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